

THE MICROLEVEL PERCEPTION OF CLIMATE CHANGE: THE DYNAMICS OF HILL ECOLOGY IN INDIA

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Abstract—People's perception on climate change offers a splendid opportunity to the climate researcher to generate a model for community level mitigation and adaptation strategy. This may go immensely implicative in complementing the lacunae of GCM (Global Circulation Model) for redressing micro level need for weather intelligence and monitoring. The melting of snow cover, the rise of mean temperature, the loss of biodiversity etc, are the evidences of imminent losses and deleterious impact on agriculture, human life and biodiversity which may be elicited as social ecology. In the present study, the Hill ecosystem of North Sikkim has been selected as a research locale to estimate the people's perception on the impact of climate change on this fragile ecosystem. The variables Y_1 (Climate change perception), Y_2 (Yield change perception), Y_3 (Water bodies perception), Y_4 (Health problem perception), Y_5 (Species decline perception), Y_6 (Perception indicator change), Y_7 (Landslide perception), Y_8 (Distance perception), Y (Comprehensive climate change perception) have been selected and customised as core of Predictants, against which the following variables X_1 (Age), X_2 (Education), X_3 (Family size), X_4 (Media interaction), X_5 (Per capita holding size), X_6 (Cropping intensity), X_7 (Technology socialization status), X_8 (Family income), X_9 (Expenditure after health), X_{10} (Animal health mentoring), X_{11} (Location of the market), have been selected as to have causal impact on the above stated perceptual variables. It has been found that the variable X_2 (Education) has got decisive impacts on climate change perception. While path analysis has been carried out the variable X_3 (Family size) has exerted the HIDE (Highest Indirect Effect) on climate change perception. The correlation analysis has evinced that the variables X_2 (Education), X_6 (Cropping intensity), X_8 (Family income), have been significantly correlated with climate change perception. Canonical correlation analysis has been conducted to determine whether two set of variables are in independent of one another or conversely determining the magnitude of the relationship.

Keywords: Climate change, Hill ecosystem, Global Warming, Perception Indicator, Socialization Dynamics, Health Mentoring, Geo-Diversity

1. INTRODUCTION

Climate change and Global Warming have taken the civilization by storms, any sensible minds anywhere in the

world is now taking Climate Change as an effective threat to the very existence of its own and surrounding. After climate change and global warming, there are ten sub-thousands of factors which can be classified as natural, meteorological, astronomic anthropogenic and a mix of all these mentioned already. For a good count of times, the good earth has passed through a cycle of global warming and cooling, the ice ages. The present global warming scenarios, as experts across the world, claim that it is mostly due to anthropogenic factors. The change in night temperature, rainfall pattern, setting of monsoon and winter, withdrawal of snowlines from its previous expansion, all are indicators and predictors of climate change. It is due to global warming, the yield of most of the conventional crops shall decline, floral and faunal diversity would be affected, the coastal lines will be inundated enough to promote migration.

The Hill Ecosystem is possibly going to be the worst hit. The melting of snowlines and its movement, the change of river courses and drying out of water bodies, the decline of productivity and bio-diversity increased seismic vulnerability all would take the ecosystem with higher fragility and vulnerability.

The unplanned urbanization in hill ecosystem, mindless construction work including depletion of dolomite and multistory buildings are being associated with deleterious impact of global warming hill ecosystem is now at the crux of global concern. Any global threat should not be confined only to minds of experts or scientists the threat of climate change must properly be perceived by the people across the profession and pursuits.

Perception is the experience based disposition of learning and idea. Even with increasing propensity of cyclones, extreme summer and winter, rising of sea levels, landslides and avalanches, people do not perceive it from the point of global warming and climate change, yet. Befitting extension strategy

has also been the need of the hour to involve people in the people's participatory movement to mitigate climate change risk and disaster.

So the present study has envisaged the People's Perception down the line of experience and elements of learning, people's perception should be conceived as one of the most important predictant to be estimated through a set of exogenous variables in estimating climate change and its effect on social ecology as well as natural ecological set up at length.

There is a worldwide consensus that global warming is a real, rapidly advancing and widespread threat facing humanity this century. Scientists have presented evidence and tested models to substantiate this truly alarming fact (Chaudhary & Aryal, 2009).

In order to understand how human beings would respond to climate change, it is essential to study people's perceptions of climate and the environment in general. (Vedwan et al.2001). Human expectations regarding weather and climate sometimes lead to perceptions of climate change which are not supported by observational evidences (Rebetz 1998). Studies focusing on the socioeconomic aspects of climatic change are sparse and have almost exclusively restricted their analysis to the impact of environmental modifications on agricultural production (Scott et al. 1990). Micro-level studies of the impact of climatic variability on people's livelihoods and their consequent responses are relatively few.

Thus, this study is important in a way that it takes into account local people's awareness of weather fluctuations and aims at understanding the localized impact of the climate in this region which are not directly visible but changes, nevertheless, are happening indirectly. This kind of study can prove to be vital to arrive at an understanding of patterns in human responses, for future studies. This sort of work was needed to know- 'what one thinks' and 'how one thinks' about the changes in climatic patterns and their impacts; and to give an account of understanding and responses about the changes in the plains.

Himalayan degradation coupled with global warming is imposing severe threats to the existing environmental problems. Recent modelling studies suggest that the forest ecosystems can be seriously impacted by future climate change. Even with a rise in 1 to 2 o C, much less than the most recent projections of warming during this century, most ecosystems and landscapes will be impacted through changes in species composition, productivity and biodiversity. These will also Have an impact on the people who depend upon the forests for their livelihoods. Due to the impact of global warming, the atmospheric temperature is increasing in a dramatic manner, which has raised the surface air temperature of the Himalayan region by 1 oC2 .The concept of climate change and its consequences have been theorized, discussed

and predicted by the scientists and environmentalists world-wide during the last two decades. However, there is little or no micro-level study depicting the actual change in climatic conditions and its impact on people and natural resources, particularly in a developing country like India.

Having this brief background in place, the present study has got the following objectives:

2. OBJECTIVES OF THE STUDY

- To estimate the People's Perception on Global Warming, Climate Change and effect on Hill ecosystemTo estimate the people's perception on Global warming through a set of predictor's variables.
- To assess the interactive relationship between predictors and predict ant variable, both intra and inter levels.
- To derive some policy implication that could be well implicative in designing and formulating micro level policy for mitigating Climate Change, especially in hill ecosystem.

3. METHODOLOGY

The purposive as well as simple random sampling techniques were adopted for the present study. It may be termed as multistage random sampling procedure. The districts, sub-division and villages were purposively selected for the study. The North district and the sub-division Mangan were considered. Under the Mangan Sub-division Phodong forest block village was selected.100 respondents were selected randomly from each village for the final data collection.Statistical tools like coefficient of correlation and canonical covariate were applied.**Results and revelation**

Table 1: Coefficient of Correlation between Climate Change Perception (Y1) and Independent Variables (X1.....X11)

Sl. No.	r-Value
AGE (X1)	-0.069
EDUCATION (X2)	0.246*
FAMILY SIZE (X3)	0.024
MEDIA INTERACTION (X4)	0.078
PER CAPITA HOLDING SIZE (X5)	-0.134
CROPPING INTENSITY (X6)	-0.018
TECHNOLOGY SOCIALIZATION STATUS (X7)	0.143
FAMILY INCOME (X8)	0.101
EXPENDITURE ON HEALTH (X9)	0.080
ANIMAL HEALTH MENTORING(X10)	-0.103
LOCATION OF THE MARKET (X11)	-0.194

(Significance of r at 0.05 level = 0.242)*

Table-1 presents the coefficient of correlation between climate change perception (Y1) and, eleven independent variables. It has been found that the variable, **Education (X2)** has recorded a positive and significant correlation with **Climate change perception (Y1)**. Education simmers the process of cognitive changes, motivational changes and motor changes in a positive direction. The education of the respondents, here, has got a strong associational impact in generating a better perception of climate change. It has helped having an observation to take account of a miniscule to a major climatic change that has impacted on changing agriculture, animal enterprise, public health, biodiversity reduction and so on.

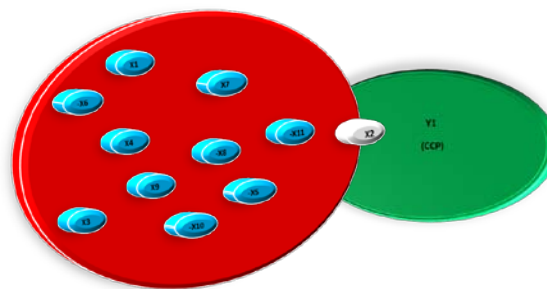
Table 2: Coefficient of Correlation between Yield Change Perception and independent variables(X₁.....X₁₁)

Sl. No.	r-Value
AGE (X1)	0.030
EDUCATION (X2)	0.252*
FAMILY SIZE (X3)	-0.038
MEDIA INTERACTION (X4)	0.204
PER CAPITA HOLDING SIZE (X5)	-0.120
CROPPING INTENSITY (X6)	-0.158
TECHNOLOGY SOCIALIZATION STATUS (X7)	0.083
FAMILY INCOME (X8)	0.100
EXPENDITURE ON HEALTH (X9)	0.031
ANIMAL HEALTH MENTORING (X10)	0.145
LOCATION OF THE MARKET (X11)	-0.376**

(Significance of r at 0.05 level= 0.242)*
 (Significance of r at 0.01 level= 0.315) **

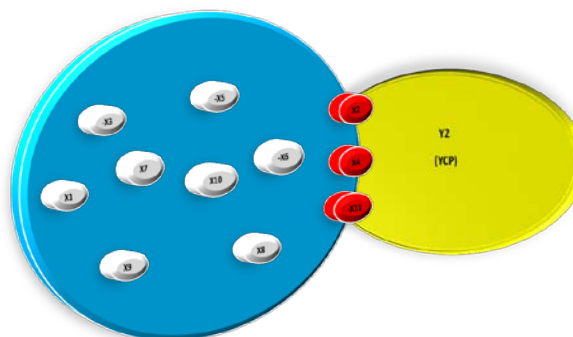
(Significance of r at 0.10 level= 0.204) Table-2 presents the coefficient of correlation between yield change perception (Y2) and eleven independent variables. It has been found that the variable Media interaction (X4) and Education (X2) has recorded a positive and significant correlation with Yield change perception (Y2). The other variable Location of the market (X₁₁) has recorded a negative but significant correlation on Yield change perception (Y2). Education helps the respondents move for a wider and diverse exposure to farm enterprises and farm operation and consequently build up a meticulous observation or yield decline or change. The variable, media interaction (X4), has also exerted positive bearing on YCP (at 10% level) Shorter the distance to market from dwelling place, the higher would be the market interaction, which would help to take a note on market lending of different crops, fishes, vegetables and heir trend of decline in the local areas of production.

MODEL-1:- COEFFICIENT OF CORRELATION BETWEEN CCP (Y1) AND ELEVEN INDEPENDENT VARIABLES



X2= EDUCATION (0.246)*
 CCP= CLIMATE CHANGE PERCEPTION
 The variable Education (X2) has recorded the strong and discernible impact on climate change perception (Y1).

MODEL-2:- COEFFICIENT OF CORRELATION BETWEEN YCP (Y2) AND ELEVEN INDEPENDENT VARIABLES



X2= EDUCATION (0.252)*
 X4= MEDIA INTERACTION (0.204)
 X11= LOCATION OF THE MARKET (-0.376)**
 YCP= YIELD CHANGE PERCEPTION
 The variables Education (X2), Media interaction (X4), and Location of the market (X11) have recorded strong and discernible impact on yield change perception (Y2).

Table 3: Coefficient of correlation between Water Bodies Perception and independent variables (X₁.....X₁₁)

Sl. No.	r-Value
AGE (X1)	-0.114
EDUCATION (X2)	-0.031
FAMILY SIZE (X3)	0.090
MEDIA INTERACTION (X4)	0.133
PER CAPITA HOLDING SIZE (X5)	-0.066
CROPPING INTENSITY (X6)	-0.159
TECHNOLOGY SOCIALIZATION STATUS (X7)	0.242*
FAMILY INCOME (X8)	0.032
EXPENDITURE ON HEALTH (X9)	0.163
ANIMAL HEALTH MENTORING (X10)	0.131
LOCATION OF THE MARKET (X11)	-0.055

(Significance of r at 0.05 level= 0.242) Table-3 presents the coefficient of correlation between **Water bodies perception (Y3)** and eleven independent variables. It has been found that the variable **Technology socialization status (X7)** has established a strong and positive association with water bodies

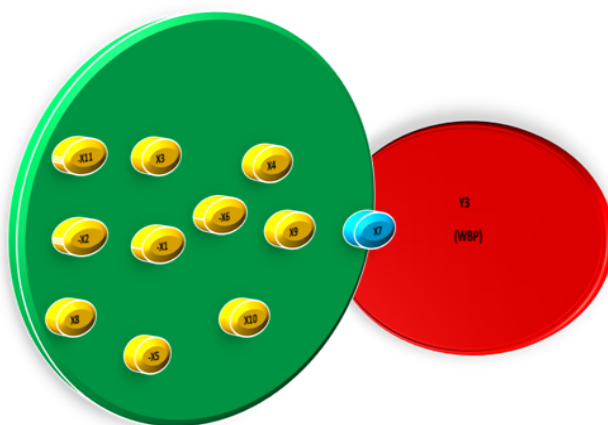
perception (Y3). Higher technology socialization status implies modern, diverse and water centric crop enterprises, and that in turn helps move closer to water body perception. Any change, decline or shift, in water location should have a paramount impact on the life and occupation, on existence and agility of a score of diasporas.

Table 4: Coefficient of Correlation between Health Problem Perception and Independent Variables(X₁.....X₁₁)

Sl. No.	r-Value
AGE (X1)	-0.092
EDUCATION (X2)	0.133
FAMILY SIZE (X3)	-0.099
MEDIA INTERACTION (X4)	0.134
PER CAPITA HOLDING SIZE (X5)	-0.059
CROPPING INTENSITY (X6)	-0.066
TECHNOLOGY SOCIALIZATION STATUS (X7)	0.165
FAMILY INCOME (X8)	0.044
EXPENDITURE ON HEALTH (X9)	0.109
ANIMAL HEALTH MENTORING(X10)	0.135
LOCATION OF THE MARKET (X11)	-0.130

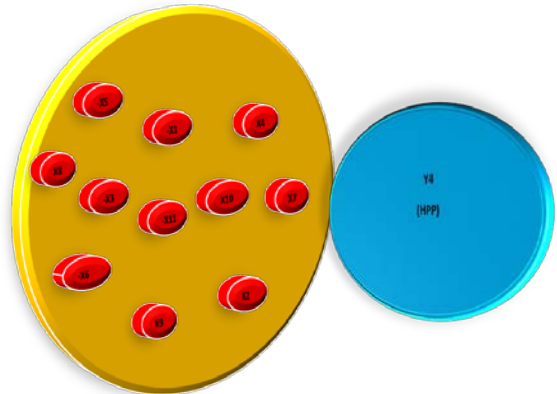
Table 4 presents the coefficient of correlation between **Health problem perception (Y4)** and eleven independent variables. It has been found that none of the variables has been found to record a significant level of correlation. By ranking the values in an ascending manner, it has been found that the variable **Technology socialization status (X7)** has got a near significant relationship with health problem perception. To elicit the directional flow of relation, the coefficient values have undergone path analysis subsequently.

MODEL-3:- COEFFICIENT OF CORRELATION BETWEEN WBP (Y3) AND ELEVEN INDEPENDENT VARIABLES



X7=TECHNOLOGY SOCIALIZATION STATUS (0.242)*
 WBP= WATER BODIES PERCEPTION
 The variable Technology socialization status (X7) has recorded strong and discernible impact on water bodies' perception (Y3)

MODEL-4:- COEFFICIENT OF CORRELATION BETWEEN HPP (Y4) AND ELEVEN INDEPENDENT VARIABLES



HPP= Health problem perception
 None of the variables has recorded significant correlation with the dependent variable Health problem perception (Y4). However, the variables are set following their proximity in the interaction with dependent variable.

Table 5: Coefficient of Correlation between Species Decline Perception and Independent Variables(X₁.....X₁₁)

Sl. No.	r-Value
AGE (X1)	0.005
EDUCATION (X2)	0.023
FAMILY SIZE (X3)	-0.088
MEDIA INTERACTION (X4)	0.070
PER CAPITA HOLDING SIZE (X5)	0.005
CROPPING INTENSITY (X6)	0.058
TECHNOLOGY SOCIALIZATION STATUS (X7)	-0.187
FAMILY INCOME (X8)	0.047
EXPENDITURE ON HEALTH (X9)	-0.28
ANIMAL HEALTH MENTORING(X10)	-0.017
LOCATION OF THE MARKET (X11)	-0.250*

(Significance of r at 0.05 level= 0.242)*

Table 5 presents the coefficient of correlation between **Species decline perception (Y5)** and eleven independent variables. The variable **Location of the market (X₁₁)** has recorded significant but negative association on Species decline perception (SDP).The result shows that the lesser the distance of market, the higher has been the perception on species decline. The areas are conspicuous by having traditional markets (e.g.-Chongthang) blessed with landing of local vegetables , pieces and animal resources for sale . The close and proximate interaction with local market should provide the keen observation for any person frequent to the market staying at a shorter distance on the arrival of different vegetables and heir decline of landing.Market in this study has contributed to build up a perception of species decline through an intimate stock checking of differential market landing.

Table-6: Coefficient of Correlation between Perception Indicator Change and Independent Variables (X₁.....X₁₁)

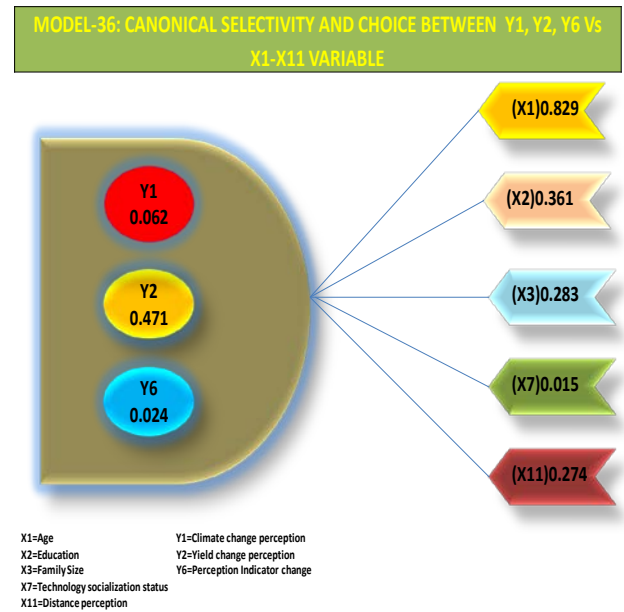
Sl. No.	r-Value
AGE (X1)	0.034
EDUCATION (X2)	0.203
FAMILY SIZE (X3)	-0.176
MEDIA INTERACTION (X4)	-0.164
PER CAPITA HOLDING SIZE (X5)	-0.090
CROPPING INTENSITY (X6)	-0.195
TECHNOLOGY SOCIALIZATION STATUS (X7)	-0.285*
FAMILY INCOME (X8)	0.510**
EXPENDITURE ON HEALTH (X9)	-0.037
ANIMAL HEALTH MENTORING (X10)	0.136
LOCATION OF THE MARKET (X11)	0.001

(Significance of r at 0.05 level= 0.242)*
 (Significance of r at 0.01 level= 0.315) **

Table-6 presents the coefficient of correlation between **Perception indicator change (Y6)** and eleven independent variables. It has been found that the variable **Technology socialization status (X7)** has recorded significant but negative association with Perception indicator change. The other variable, **Family income (X8)**, has got a strong and negative association with Perception indicator change (PIC). It perhaps suggests that the respondents have been low key technology socialization process, getting closer to traditional cultivation practices or customs, have a better prediction or estimation on climate change by using local indicators. Modernization as a process and as an approach as well may have drifted the tension of the respondents away from the proximate observation of minute to mega changes in climatological behaviour and their proportionate impacts on from the dynamics of hill ecosystem as evinced through this ecosystem. Higher income permits and provokes wider geographical movement and at the same time intimate interaction with the variance of ecological set up and climatological variance. However a suitable path analysis can elicit the directional analysis of this influences to take and estimate that what are the contribution of direct effect of this variables on the Perception indicator change.

Model 5: depicted that with the change of the left side variables viz. Y1, Y2, Y6. The following variables viz. X₁, X2, X3, X7, X₁₁ from the right side set of predictors are being impacted. This will provide both strategic and operational support for handling with different set of variables within a domain of interaction and variability behaviour of the total scope of variables. Model also depicted that with the change of the left side variables viz. Y3, Y4, Y5, Y7. The following variables viz. X4, X5, X6, X8, X9, X10 from the right side set of predictors are being impacted. This will provide both strategic and operational support for handling with different set of variables. Within a domain of interaction and variability behaviour of the total scope of variables.

4. CANONICAL SELECTIVITY AND CHOICE BETWEEN: Y1, Y2, Y6, VS X1-X11



5. CONCLUSION

Hill ecosystem by nature and operation is very complex and sensible to even a tiny change in the entire atmospheric behaviour, as per IPCC observation whole of North East in India is very much prone to seismic behaviour and vulnerable to climate change and Global warming. So, long and henceforth, the climate change concerns reviews confined to scientist community and elite Diaspora of intellectuals. The present study with Kaleidoscopic vision has attempted to depict pathway to construct people’s perception or being affected by a social and ecology echilons. This has amounted to a policy formulating process wherein the variable found significantly attuned to climate change perception may be segregated and put to a policy formulation process. Education still remains a very critical input to make people aware of and operational enough towards making the ecology of the hill amply resilient in the face of climate change. The down to earth reality is that people are becoming increasingly knowledgeable about the ecological health and its capability to absorb the third of climate change but it has turned very difficult to make them adequately operational to sufficiently perform for what you need to do right now. The outcome of the research thus would go a long way in institutionalising external efforts with that of internal potentials for creating climate managers atleast one for each villages so that a good leadership can be built up, both at the top and in a valley of the Hill ecosystem.

REFERENCES

- [1] Chaudhary, P. and Aryal, K. P. 2009. Global Warming in Nepal: Challenges and Policy Imperatives. *Journal of Forest and Livelihood*, **8**(1): 5-14.
- [2] Rebetz, M. 2000. Public expectations as an element of human perceptions of climate change. *Climatic change*. Springer, Netherlands, **32**: 495-509.
- [3] Scott M.S., Rosenberg, N. J., Edmonds, J. A. and Cushman, R. M. 1990. Consequences of climate change for human environment. *Clim Res.* **1**: 63-79.
- [4] Vedwan, N. and Rhoades, R.E. 2001. Climate change in the Western Himalayas of India: a study of local perception and response. *Climate Research*. **19**: 109-117.